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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/886,511	06/21/2001	Karen L. Coates	99-315A	6891

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THE BOEING COMPANY
P.O. BOX 3707 M/C 13-08
SEATTLE, WA 98124-2207

EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	**PAPER NUMBER**
1753	

DATE MAILED: 04/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/886,511	COATES ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 February 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *13-17* is/are pending in the application.

4a) Of the above claim(s) *16 and 17* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 15 is rejected under 35 U.S.C. 102(b) as being anticipated by Hohenstein "Cermet Resistors by Concurrent rf and dc sputtering", Communications, October 1967, pp. 65-66.

Hohenstein teach a resistive film with a specific resistivity of .0021ohm-cm in Table I. The film can be etched by rf etching with no annealing. (pp. 56)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 13,14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Norimitsu (Japan 01-256101) in view of Kaiser et al. (U.S. Pat. 4,591,417), Hohenstein "Cermet Resistors by Concurrent rf and dc sputtering", Communications, October 1967, pp. 65-66 and Jankowski et al. (U.S. Pat. 6,217,722).

Norimitsu teach a resistor 2 composed of tantalum-silicon oxide (***Ta-SiO_2***) with a ***0 to –500 ppm*** in the resistivity range of ***1-100 milliohm-cm***. ***The TCR can almost be equal to zero by performing Ta-SiO_2 sputtering, wherein a target whose SiO_2 mol ratio in the target composition ratio is in a range of 30-70%, and argon gas pressure is kept about $1*10^{-2}$ Torr. (i.e. 10 mTorr)*** (See Abstract) From Figure 2 the SiO content versus TCR is the shown. ***From Figure 3 the pressure versus TCR is shown.*** (See Figures 2 and 3)

The differences between Norimitsu and the present claims is co-sputtering is not discussed, is that co-sputtering utilizing DC for the metal target and RF for the insulator target is not discussed, the requirement for power is not discussed, the etching is not discussed, the use of a magnetron is not discussed and the thickness of a resistive film is not discussed.

Kaiser teach that it is well known in the prior art to sputter from a composite target to produce a particular composition resistive film with the disadvantage being that sputtered particle size vary through the film. (Column 1 lines 31-33; Column 2 lines 11-22)

Kaiser suggest a method to solve the above problem by sputtering from two targets with adjustable power to control the composition of the cermets. (Column 2 lines 25-31)

The metal volume fraction of cermets can be easily changed by changing, for example, relative power applied to the two targets, whereas in the prior art co-sputtering method, the target composition must be changed each time it is desired to change the metal volume fraction. (Column 2 lines 65-68; Column 3 lines 1-2)

Radio frequency power and monitoring circuits 50 and 51 are coupled to targets 40 and 41, respectively, so that the sputtering process can be adjusted, controlled and monitored. (Column 3 lines 64-67) ***The relative amount of material deposited on substrate 39 from each target 40, 41, which determines the composition of the cermet, is precisely controlled by the ratio of the powers supplied to each target 40, 41 by the power and monitoring circuits 50 and 51.*** (Column 4 lines 16-21)

In summary, the metal insulator composition of the cermet is dependent on the relative rates of deposition of the metal and the insulator. (Column 4 lines 32-35)

The choice of the relative power to the Au and silicon dioxide targets determine the metal volume fraction. (Column 5 lines 22-23)

The motivation for controlling the power to targets for sputtering is that it allows for control of deposition rate for control of the composition of the film with control of particle size. (Column 2 lines 65-67;Column 2 lines 11-22)

Hohenstein teach making a thin-film resistor of extremely high resistance by ***dc sputtering*** a metal while concurrently sputtering a ceramic using the ***radio frequency sputtering technique.*** (Page 65) The method involves pumping the system to a pressure of $5 * 10^{-7}$ Torr and backfilling with argon to a pressure of $5 * 10^{-3}$ Torr. The argon flow is stabilized at 4.7 cm3/min. The plasma is carried by the anode circuit at 45 V and 3 ½ A. The voltage and current for the metal electrode and the ceramic electrode are varied depending on the electronic characteristics desired in the film and the metal used. For the metal electrode, the voltage range was 400 V to 1200 V; current range was from 70 mA to 250 mA. ***For the Pyrex electrode, the rf power output was from 200 to 600 W. (Page 66)*** Sheet resistance varied from 7.5 ohm/square to 4 Mohm/square. ***Specific resistance varied from 10^{-6} to $2 * 10^{-1}$ ohm cm.*** The temperature coefficient of resistance varied from about -400 parts per million for a low-resistance film, to about 2000 ppm for the very high resistance films. (Page 66)

One factor influencing resistivity is the power to the ceramic electrode (i.e. silicon dioxide electrode). (page 56)

For etching the cermets, the rf-etching technique can be used. (pp. 56)

The motivation for utilizing combined DC and RF sputtering techniques with control of power is that it allows production of resistive films with a controlled resistance. (Page 66)

Jankowski et al. teach rf sputter depositing from a ceramic target using a reactive working gas mixture of Ar and O2. The film resistivity can be discretely selected through control of the target composition and the deposition parameters. (See Abstract) Fig. 3 graphically illustrates resistivity variation with oxygen partial pressure as measured at 10 volts for deposition conditions of a 6 mTorr total working gas pressure and a 6 Watts cm^{-2} applied target power. (Column 4 lines 18-21)

A gas pressure ranging from ***2 mTorr to 15 mTorr*** is typically used to operate the ***planar magnetron source.*** A substrate is used with an electrically conducting surface, as for example a metal-coated silicon wafer. (Column 4 lines 56-60)

The rf sputter deposition is carried out using an energy in the range of about 2 to about 20 Watts cm^{-2}. (Column 6 lines 35-37)

The thickness of the resistive films can be less than 1 micron thick. (See Abstract)

The motivation for utilizing a magnetron for sputtering is that it allows for deposition of a resistive film with stable behavior. (Column 2 lines 24-26)

Presumably the Rs, TCR and resistivity will be the same as Applicant's claims since the process conditions are taught by the combined references which recognize the significance of power and pressure when sputter depositing resistive films.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Norimitsu by co-sputtering with controlled power to target for compositional film control as taught by Kaiser et al., to have co-

sputtered utilizing DC for the metal target and RF for the insulator target within a particular power range and to have etched as taught by Hohenstein et al. and to have utilized a magnetron and particular thickness of a resistive film as taught by Jankowski et al. because it allows for deposition of a resistor with controlled resistance and stable behavior.

Response to Arguments

Applicant's arguments filed 2-5-04 have been fully considered but they are not persuasive.

At the outset it should be noted that the 35 U.S.C. 112, 1st paragraph rejection has been withdrawn. The other rejections have been maintained.

RESPONSE TO THE ARGUMENTS OF 35 U.S.C. 102 REJECTION:

In response to the argument that Hohenstein et al. do not teach a resistors exhibiting all of the desired properties simultaneously, it is argued that claim 15 only requires one property for the resistor that being the resistivity. Hohenstein et al. teaches the required resistivity in claim 15 and thus teaches the required properties of this claim.

RESPONSE TO THE ARUGMENTS OF THE 35 U.S.C. 103 REJECTION:

In response to the argument that the references do not teach all of the desired properties simultaneously of the resistor, it is argued that the primary reference teaches the composition, TCR value and resistivity required by Applicant's claims. While the primary reference is silent on Rs value it is believed that the Rs value directly corresponds to the composition, TCR value and resistivity taught by the primary

reference. Furthermore, the primary reference recognizes that control of pressure will affect the properties of the thin film resistor as well as the amount of insulator incorporated into the thin film. The secondary references suggest that control of power to a resistive sputtering target during cosputtering will affect the composition of a deposited resistance film. Hohenstein et al. in fact teach operating at powers within Applicant's required powers. Therefore it is believed that one of ordinary skill in the art would readily envisage controlling the pressure and power to a sputtering target in order to achieve the desired the composition, TCR, Rs and resistivity values of the resistive film. The primary reference directly suggesting the composition, the TCR and resistivity of Applicant's required claims and the Rs value directly corresponding to these properties.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
April 14, 2004